A NEW ISCHNACANTHID ACANTHODIAN FROM THE LATE SILURIAN (LUDLOW, *PLOECKENSIS* ZONE) JACK FORMATION, NORTH QUEENSLAND

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Scales, fin spine fragments, two symphysial tooth whorls, a dentigerous jaw bone fragment, and dentition cones of a new acanthodian species comprise the total acanthodian component from samples of the Jack Formation. The morphological variety of scales includes three normal body scale types, two specialized head scale types, pore scales and tesserae. The range of scale types, the shape of the fin spine fragments, and the form of the dental elements, indicate they are from a new species of ischnacanthid acanthodian. ☐ *Acanthodii, Jack Formation, Gomphonchus, ischnacanthid, Ludlow, microvertebrates, scales.*

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Acanthodian scales are common in microvertebrate assemblages from Upper Silurian and Devonian limestones throughout Australia, but until recently there have been no systematic descriptions of them. Burrow (1995a) described several new taxa from the late Lochkovian/early Pragian Connemarra Formation and Gleninga Formation (including the Jerula Limestone Member) of central New South Wales. Turner & Pickett (1982) were the first to report Acanthodian scales from the Silurian of Australia. Turner (1991, 1993) recorded various occurences of Acanthodian remains from Silurian deposits in eastern Australia, including material described in this paper. The present paper describes the microvertebrate assemblage in an acetic acid-treated samples from the Jack Formation of northern Queensland. The acanthodian component appears to derive from a single species. The only other vertebrate element in the section is a scale of the primitive osteichthyan *Lophosteus* cf. *L. superbus*, the type material of which is from Pridoli deposits in the Baltic. Material is lodged in the Geology Museum, University of Queensland (UQY).

STRATIGRAPHY

Vertebrate remains were recovered from samples processed to extract conodonts from the Jack Formation (Simpson, 1983, 1994b), the uppermost unit of the Graveyard Creek Group, Broken River Province, north Queensland (Fig. 1). The Group consists of the predominately siliciclastic Crooked Creek Conglomerate, Quinton Formation and Poley Cow Formation, and siliciclastics and carbonates of the Jack Formation.

The Jack Formation, originally the Jack Limestone Member of the Graveyard Creek Formation (White, 1959), previously included only carbonate lithologies exposed in the area around the Broken River where it is cut through by the Jack Hills Gorge. Remapping of the area by the Geological Survey of Queensland raised the unit to formation-status (Withnall, 1989) and broadened its concept to incorporate siliciclastic rocks, interpreted as lateral equivalents of the carbonates in areas to the north and south (Withnall et al., 1993). Recent work (Sloan et al., 1995) has shown that some of these lateral equivalents may represent allochthonous deposits post-dating some autochthonous outcrop tracts of the Jack Formation.

The Jack Formation conformably overlies and interfingers with the Poley Cow Formation (Fleming, 1986; Withnall & Fleming in Withnall et al., 1993). It is disconformably overlain by siliciclastics of the Early Devonian Shield Creek Formation.

Specimens described here are from sections along Bullock Creek through the western limb of an unnamed, southwesterly plunging syncline, located 0.5 km to the south west where the Pandanus to Wandovale road crosses the Broken River, east of the axis of the Broken River Anticline (Withnall & Lang, 1992). The core of this syncline consists of two distinct lithologies of the Jack Formation. This region was mapped as undifferentiated Jack Formation by Withnall & Lang (1992). Brief notes on the lithology are

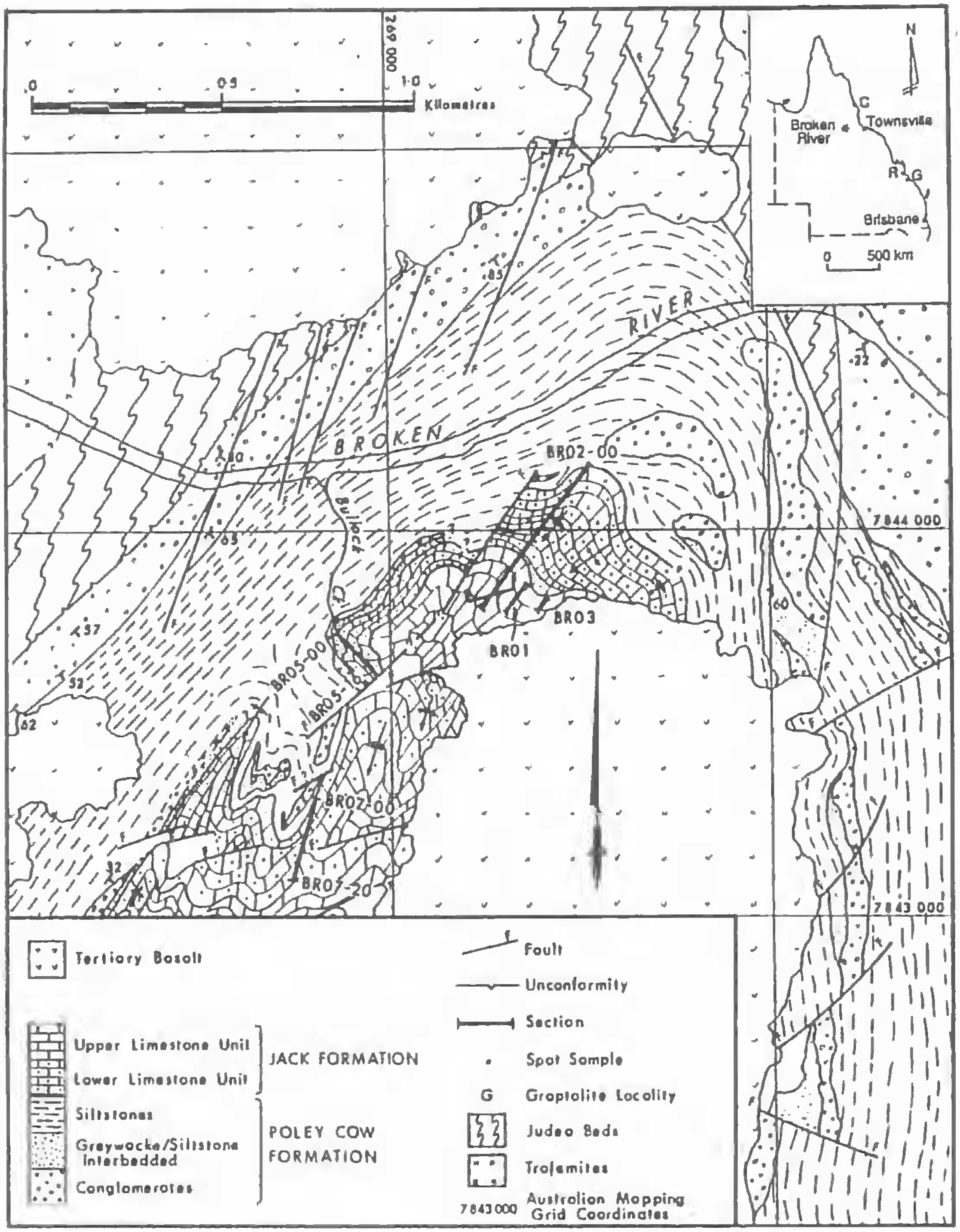


FIG. 1. Map of syncline near Broken River crossing showing location of sections through the Jack Formation, north Queensland. Acanthodian remains are from Section BR07 (Upper Bullock Creek Section), in near basal samples BR07-01 and BR07-02.

given below, as the sequence in the syncline differs from the type section 4km to the west, in the Jack Hills Gorge (Withnall & Fleming in Withnall et al., 1993).

In the syncline, the lower part of the Formation consists of thin-bedded siltstone and fine-grained, micaceous arenite interbedded with a range of carbonate lithologies, many with abundant corals in growth positions; a highly variable sequence colloquially known as the "coral gardens" (lower limestone unit, Fig. 1). The basal sequence of the "coral gardens" unit has, in places, discontinuous, lenticular beds of calcirudite, which crop-out sporadically around the nose of the syncline. One of these has been interpreted as a massive debris flow, possibly part of a channel cutting through autochthonous carbonates and clastics of the coral gardens unit (Sloan et al., 1995: 52). As well as conodonts of the *ploeckensis* and *siluricus* Zones, and acanthodian material, carbonates of the coral gardens unit have also yielded foraminifera, algae, sponge spicules, byronids and phyllocarid remains (Simpson, 1994).

The "coral gardens" unit at the Broken River crossing is overlain by a massive- to thinly-bedded upper limestone unit (Fig. 1). Thicker to massive beds consist of fine-grained muddy and dolomitic limestone containing minor corals and stromatoporoids. Thinner beds consist of a variety of lithologies, including beds of richly bioclastic detritus. These may consist of a range of skeletal allochems or may be dominated by a single allochem. Dominant allochems include large articulated crinoid stems, some with oncolitic envelopes, large, low-spired gastropods, and abundant brachiopods. The upper limestone unit has yielded the conodont *Icriodus woschmidti hesperius* Klapper & Murphy some 45m above the base, indicating the approximate position of the Silurian-Devonian boundary. A broad study of the Jack Formation (Simpson, 1995) shows that it extends into the Devonian only in this area. In all other regions including the type section the uppermost beds of the formation all terminate within the Silurian.

A review of biostratigraphic data pertaining to all the constituent units of the Graveyard Creek Group has been recently presented (Jell, et al., in Withnall et al., 1993).

Samples yielding acanthodian remains were all restricted to the "coral gardens" unit of the Jack Formation from the Upper Bullock Creek section (Simpson, in press). Acanthodian elements were most abundant in samples BR07-01 and BR07-02, some 7m and 10m stratigraphically above the base of the Jack Formation, but were also recovered much higher in the section, just below the first appearance of *Polygnathoides siluricus*. The age of these samples is discussed separately below.

AGE OF THE SAMPLES

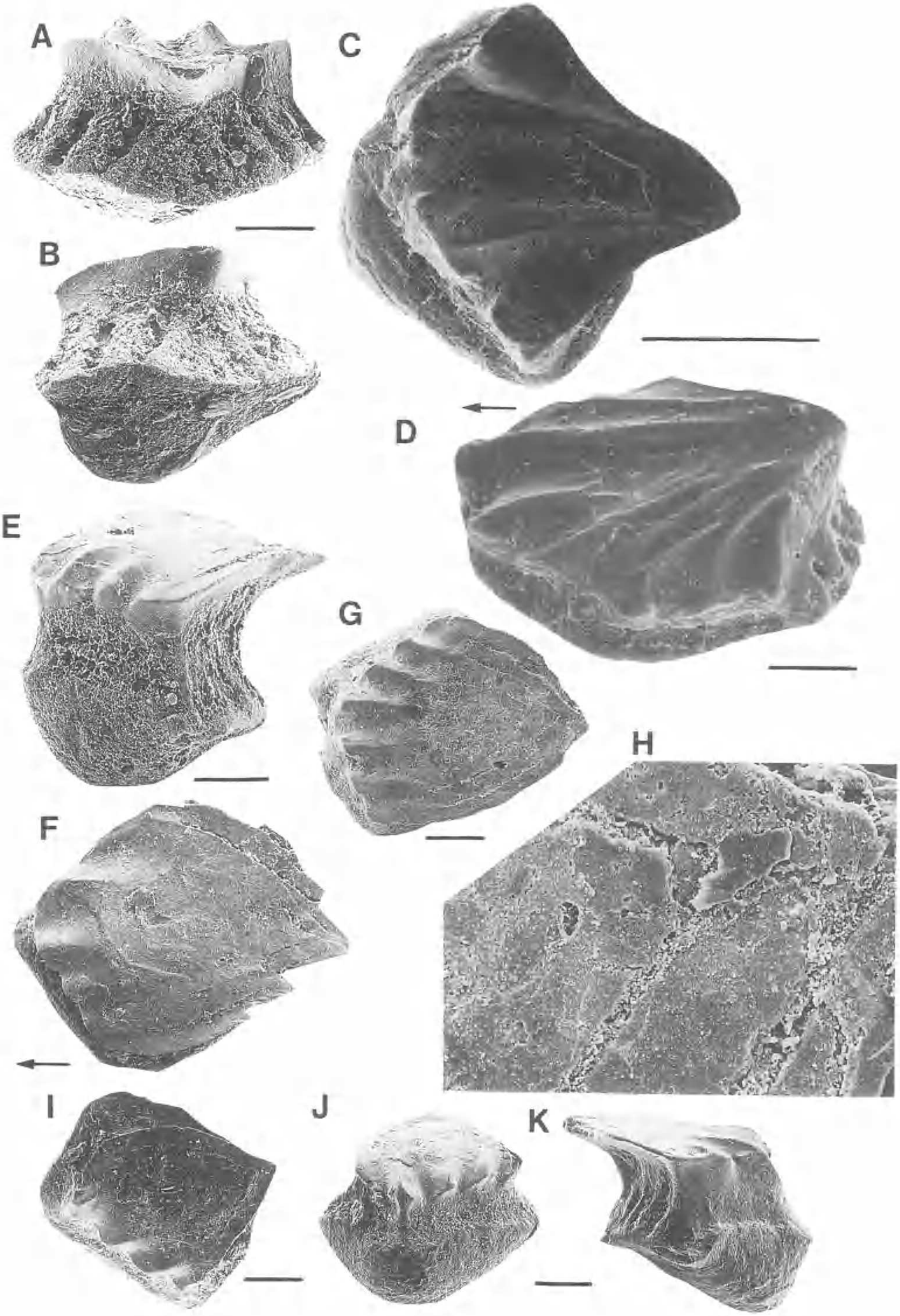
Basal samples of the Upper Bullock Creek section through the "coral gardens" unit of the Jack Formation yield the Ludlow zonal index conodont *Ancoradella ploeckensis* (Walliser, 1964). The species ranges through the lower 95m of section equalling approximately the lower 75% thickness of the "coral gardens" unit (Simpson, in press). The succeeding Ludlow zonal index, *P. siluricus* occurs in small numbers over a narrow stratigraphic range in the upper part of the range of *A. ploeckensis*. The stratigraphic overlap of these two species is well established and has been discussed by a number of authors (Klapper & Murphy, 1975; Simpson & Talent, 1995) and has been recorded previously in Australia (Link & Druce, 1972).

Although recent work (Simpson & Talent, 1995) has shown that *A. ploeckensis* probably extends back into the late Wenlock, there is no evidence to suggest that basal samples of the Jack Formation (in section BR07) are any older than Ludlow. The associated conodont fauna is typically Ludlow in aspect. Furthermore, morphometric analysis of *Pa* elements of *A. ploeckensis* (Simpson, 1994a; Simpson & Talent, 1995) suggest Ludlow rather than late Wenlock examples.

As noted above, acanthodian specimens documented here were all recovered from strata predating the appearance of *P. siluricus*, hence permitting a fairly narrow age diagnosis for the vertebrate fauna.

The *siluricus* Zone is generally equated with the basal Ludfordian *leintwardinensis* graptolite Zone (Cocks & Nowlan, 1993). Jeppsson (1983) discussed the age of *P. siluricus* and concluded it was late? Leintwardinian or late? early Ludfordian. Other authors give a slightly older range-base for the taxon: Kleffner (1989; fig. 6) indicated a latest Gorstian age for the first appearance of the species.

As the Jack Formation Acanthodian specimens were all recovered from strata of the *ploeckensis* Zone pre-dating the *siluricus* Zone, from a section where there are no obvious stratigraphic or chronological discontinuities, the age range of the fauna can be considered, on available data, to extend from the early to middle Ludlow (Gorst-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ian), with youngest examples being probably no younger than latest Gorstian in age.

Although Australian data indicate a Gorstian age, a single element was recovered from the Lorentz River, Irian Jaya (Turner et al., 1995; fig. 5J). This locality produced a late Ludlow *crispa* Zone conodont fauna (Van den Boogaard, 1990), indicating species range throughout the Ludlow.

SYSTEMATIC PALAEONTOLOGY

Class ACANTHODII Berg, 1922
Order ISCHNACANTHIDA Berg, 1940
Family ISCHNACANTHIDAE Woodward, 1891

Gomphonchus Gross 1971

TYPE SPECIES
Gomphonchus sandelensis (Pander) 1856.

DIAGNOSIS (after Denison, 1979: 39)
Scales with a low or convex base, low or elevated crown that may be smooth or ornamented with radiating ribs. Base is cellular bone, rarely penetrated by fine canals from the inner surface. The crown is dentinous with thin layers of enameloid on top, without a well developed canal system, but with long dentine tubules that rise in the neck and turn toward the centre of the crown top, giving off side branches. Stellate platelets from the head have apposed rather than superposed growth zones. Tooth spirals carry teeth with a large cusp and small side cusps. Fin spines are slender, nearly straight, and usually ornamented with smooth, longitudinal ribs of which the anterior rib is largest. Spines are composed entirely of dentine except for a thin basal layer of bone.

Gomphonchus? turnerae sp. nov.
(Figs 2-6)

1982 'Vertebrate fragments' Turner & Pickett: 314.
1991 'Scales, spines, jaws and, tooth whorls of Acanthodians' Turner: 446-7.
1993 Scales cf *Nostolepis* and *Gomphonchus* Turner: 179.
?1995 'Acanthodii indet.' Turner et al.: fig. 5J.

DIAGNOSIS
An ischnacanthid acanthodian with a range of scale types comprising: small, 'normal' body scales with two to six sharp, longitudinal crown ribs and a median longitudinal furrow; typical ischnacanthid head scales with a broad, flat, irregularly shaped base, and apposed growth zones in the crown, and also special head scales with a long crown bearing a jagged, irregular ornament; pore scales with four to seven short, anterior crown ribs, of about four pore canal openings under the posterior crown, and up to 10 pores on the posterior crown surface; symphysial tooth whorl with four or five teeth comprising from one to five cusps, which bear longitudinal, branching, noded ridges.

MATERIAL EXAMINED
HOLOTYPE: body scale morphotype I, UQY7692 (Fig. 2C): lower part of the Jack Formation, Graveyard Creek Group, Ludlow, *ploeckensis* Zone, exposed in Bullock Creek, on the western flank of the unnamed syncline 1km southwest of the Broken River crossing on the Wandovale-Pandanus Creek road.
PARATYPES: body scale morphotype II, UQY7693 (Fig. 2D); body scale, morphotype III, UQY7694 (Fig. 2E,F); head scale, morphotype IV, UQY7695 (Fig. 4A,B); head/sensory line scale, morphotype V, UQY7696 (Fig. 4C,D); symphysial tooth whorl, UQY7697 (Fig. 6A).
OTHER MATERIAL: 303 scales, two tesserae, seven dentition cones (including UQY7698, Fig. 6E), one small dentigerous jaw bone fragment UQY7699 (Fig. 6D), two fin spine fragments (including UQY7715, Fig. 7A), and ground thin sections UQY7701-5 (Figs 3A-D, 7B,C, in order), from samples BR07-01 and BR07-02, Upper Bullock Creek section, Jack Formation.

ETYMOLOGY
In recognition of Dr Susan Turner's contribution to IGCP 328: Palaeozoic Microvertebrates.

FIG. 2. Normal body scale types of *G.? turnerae* sp. nov. from sample BR07-02, Jack Formation, north Queensland. A,B, Morphotype I scale, UQY7707 in anterior view (A), and latero-basal view (B). C, Crown view of morphotype I scale, holotype UQY7692. D, Paratype scale, morphotype II, UQY7693, latero-crown view. E,F, Paratype scale, morphotype III, UQY7694, in lateral view (E), and crown view (F). G,H, morphotype III scale, UQY7708, in crown view (G), and close-up of posterior section of scale (H). I,J, Asymmetrical scale, morphotype III, UQY7709, in crown view (I), and anterior view (J). K, morphotype III scale, UQY 7710, lateral view. Arrow points in a rostral direction; scale bar = 0.1 mm.

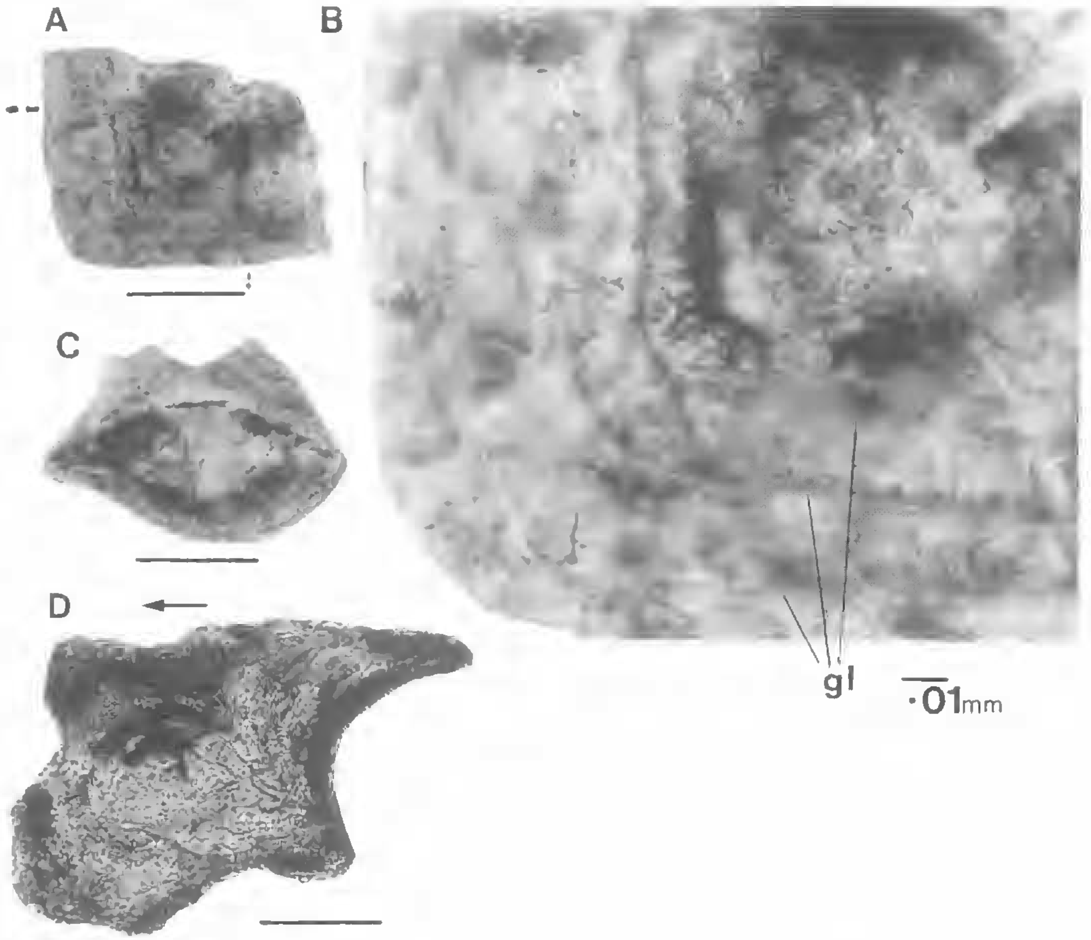

FIG. 3. Ground thin sections of scales of *G.*? *turnerae* sp. nov. from the sample BR07-02, Jack Formation. A,B, Horizontal section of crown, morphotype I scale, UQY7701; (B) is a magnified area of (A). C, Vertical transverse section of morphotype I scale, UQY7702. D, Vertical longitudinal section of morphotype III scale, UQY7703. Arrow points in rostral direction; scale bar = 0.1 mm unless stated.

DISTRIBUTION

Jack Formation, Broken River Province, northern Queensland (Ludlow, *ploeckensis* Zone); undifferentiated Palaeozoic rocks, Lorentz River, east Irian Jaya (late Ludlow, *crispa* Zone).

DESCRIPTION

Body scales, morphotype I (Figs 2A-C, 3A-C) range from 0.1 to 0.4 mm wide, and 0.1 to 0.4mm long; most scales are towards the lower size limit. They are bilaterally symmetrical, with a sub-rhombic, horizontal crown, which has a sharply marked anterior edge (Fig. 2C). Two high, strongly developed, sub-parallel ridges lead back from the anterior edge, decreasing in height towards the posterior crown edge (Fig. 2A,C). These ridges enclose a rounded, central furrow, and are flanked by relatively flat, lateral areas. Crown width and length are usually slightly less than those of the base, though the posterior crown point extends slightly beyond the base on some scales (Fig. 2C). The neck slopes away from the crown on all sides, and may have a buttressed appearance from the vertical slits, which indicate the position of canal openings on the latero-posterior neck area (Fig. 2A,B). The neck/base junction is a well-marked rim, with a lemon-shaped outline. The base has a typically 'gomphonchid'

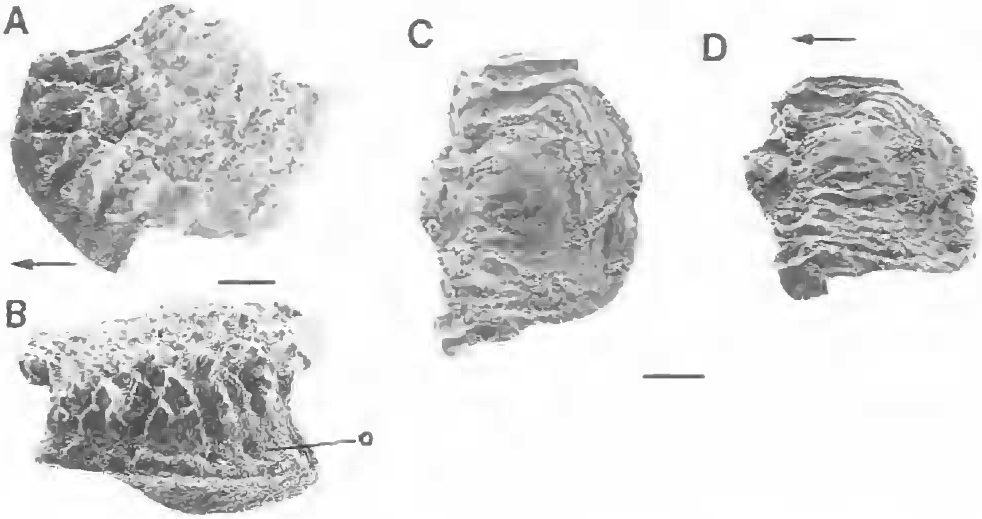

FIG. 4. Head scales of *G.? turnerae* sp. nov. from sample BR07-02, Jack Formation. A,B, paratype head scale, morphotype IV, UQY7695. A, in crown view. B, anterior view. C,D, paratype head/sensory line scale, morphotype V, UQY7696. C, crown view. D, latero-crown view. Arrow points in a rostral direction; scale bar = 0.1 mm; o = vascular canal opening.

shape, being moderately vaulted, with the swelling pushed forwards, and flattening out, or becoming slightly concave, towards the posterior rim (Fig. 2B).

Fungal hyphae and remineralization have obscured much of the histological detail of the scales; however, some details of the pattern of dentine tubules, and the structure of the base, are discernible (Fig. 3A-C). No bone cell lacunae are preserved in the base or the crown; nor are there any wide vascular canals. Small patches of dentine that are preserved (Fig. 3A,B) comprise networks of tubules without lacunae. The Sharpey's fibres of the base form a simple cone, radiating from the base apex (Fig. 3C); the bone lamellae of the base are highlighted by the interruption of the remineralized fibres.

Body scales, morphotype II (Fig. 2D) have a similar size range to morphotype I scales, and also have the distinctive central crown furrow, but differ in being more vertically compressed, and in the ornamentation of the lateral crown zones. The latter areas have several somewhat sinuous ridges leading up and back from the anterior or lateral crown edge, directed towards the central ridges (Fig. 2D). The neck is short, and the base is only slightly vaulted.

Body scales, morphotype III (Figs 2E-K, 3D) are slightly larger than those of morphotypes I and II, being 0.4 to 0.6mm wide. Their crowns usually have the same central furrow, however the ridges lining it are usually shorter and lower than on morphotype I and II scales. The anterior crown bears two to four additional short ribs (Fig. 2E,G,K). Many of the scales of this type exhibit 'cracks' delineating the growth lines of the posterior crown, but no discrete pore canal openings are visible (Fig. 2H). The posterior crown edge is denticulated on some scales, and overhangs the base (Fig. 2F). The posterior neck area is deeper than on morphotype I scales, and is marked by the same vertical slits (Fig. 2K). The anterior neck area has small, regularly spaced, circular pore openings (Fig. 2K). As on morphotype I scales, the base swelling is pushed forwards (Fig. 2E,K).

Head scales, morphotype IV (Figs 4A,B, 5C,D) are 0.3 to 0.4mm wide, and up to 0.6mm long. Some less abraded scales of this type have a micro-ornament of noded ridges (Fig. 5C,D). The crown is approximately horizontal, and its apposed growth yields an upper surface comprising a jagged, irregular ornament, which merges into the neck anteriorly (Fig. 4B). The crown is up to three times as long as the base. Small, regularly spaced, circular canal openings pierce the short, anterior neck (Fig. 4B). The base is very low or flat, and is wider than long.

Head/sensory line scales, morphotype V (Fig. 4C,D) c. 0.6mm wide and 0.5mm long. Along the relatively straight anterior edge, the crown rises

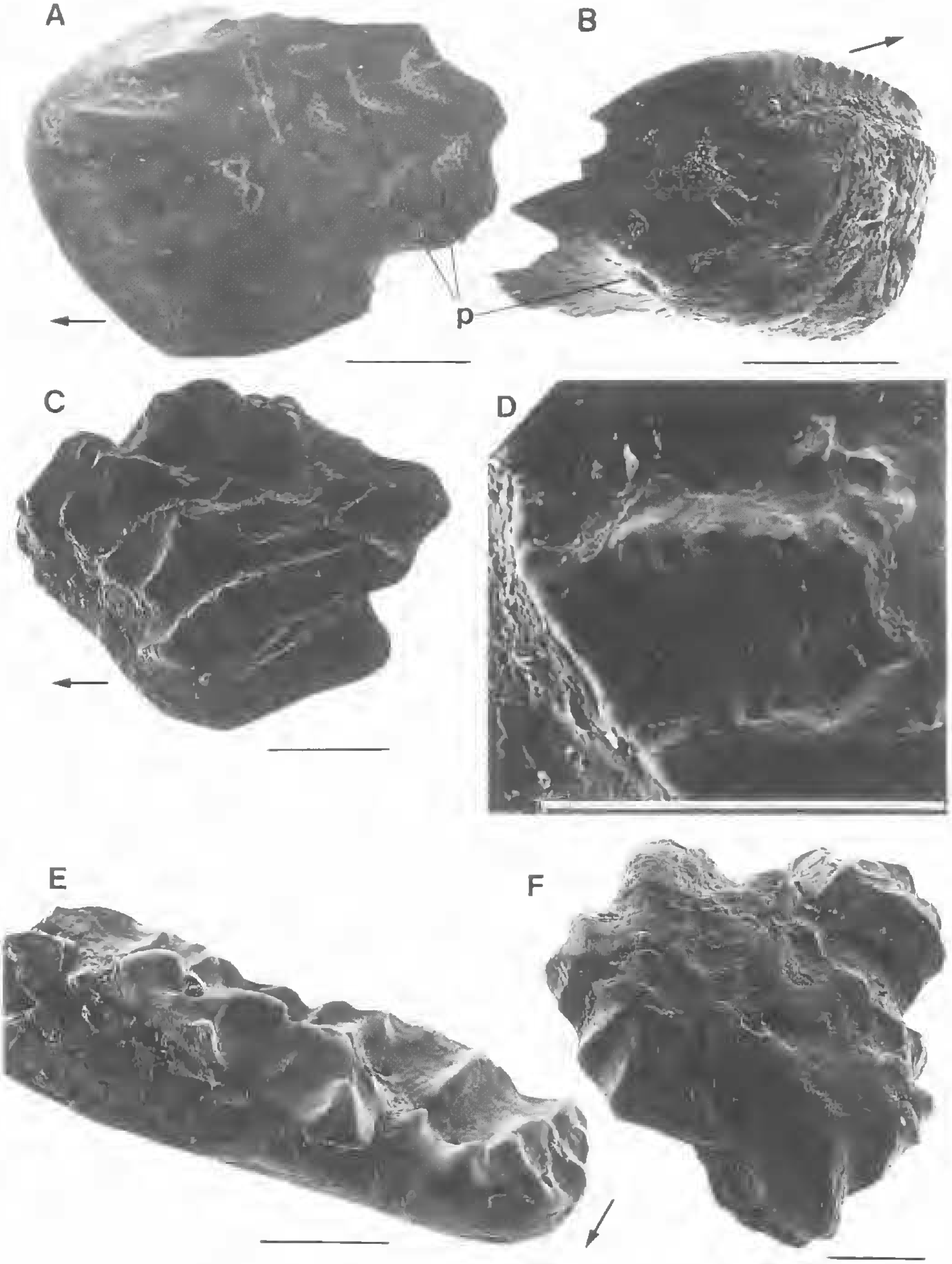

FIG. 5. Special scales of *G.*? *turnerae* sp. nov. from BR07-02, Jack Formation. A, crown view, morphotype VI scale, with pore canal openings in posterior crown, UQY7711. B, latero-basal view, morphotype VI scale, UQY7712. C,D, small head scale, morphotype IV, UQY7713. C, latero-crown view. D, close-up view, showing nodose micro-ornament. E, anterior view of short, wide scale, UQY7714. F, crown view, tessera, UOY7700. Scale bar = 0.1mm.

up sharply from the base, then curves backwards, so that the rest of the crown slopes up only slightly towards the posterior (Fig. 4D). The crown exhibits areal, rather than superpositional, growth zones, marked by ridges running parallel to the semi-circular outer crown edge (Fig. 4C,D). No pore canal openings are detectable on the main crown surface. The crown is much longer than the base, which is two to three times wider than long, and flat or with a shallow vault.

Pore scales, morphotype VI (Fig. 5A,B). A small number of scales (c. 2%) have several large pore canal openings under the posterior crown, and up to 10 (or possibly more) pores on the posterior crown surface (Fig. 5A). The scales are 0.4 to 0.5mm long, and 0.2 to 0.3mm wide. Short, rounded, sub-parallel ridges adorn the anterior crown, rarely extending to the posterior half of the crown surface. The posterior crown overhangs the base (Fig. 5B). Depth of the neck can vary markedly, being negligible below the anterior crown edge on some scales (e.g., Fig. 5A), and quite deep on others. The base/neck junction does not form a sharp rim; the bases of most of these scales lack the typical 'gomphonchid' shape of the other morphotypes. Instead, the base is relatively symmetrical, with a rounded, lumpy surface (Fig. 5B).

Several small tesserae (Fig. 5F) of 'gomphonchid' type *sensu* Gross, 1971 (pl. 2, fig. 27) were in the assemblage, and are also presumed to belong to *G.? turnerae* sp. nov.

The two symphysial tooth whorls (Fig. 6A-C) found in the sample have a base that arches from anterior to posterior, and are about 0.6mm long. The whorls bear four (UQY7697) and five teeth (UQY7706) respectively (Fig. 6A,B), increasing in size from anterior to posterior. A small, single-cusped tooth is foremost on whorl UQY7706, and the following teeth are all three-cusped, with the central cusps larger than the side cusps. The central cusp (with a broken tip) of the posterior, largest tooth of whorl UQY7706 (Fig. 6B,C) is 0.5mm high, with side cusps 0.15mm high. All cusps bear longitudinal ridges: the noded, branching ridges of UQY7697 are particularly well preserved (Fig. 6A).

Seven dentition cones (Fig. 6E) have the same form as some of those of *Poracanthodes menneri* described and figured by Valiukevicius (1992; pl. 2, figs 2,3, pl. 3, fig. 2): namely, an elongated, hollow cone, with a row of denticulations and/or randomly positioned denticles. Burrow (in press, b) characterised these elements, from Lochkovian microvertebrate assemblages of central New South Wales, as dentition cones type I and II.

One small dentigerous fragment (UQY7699 Fig. 6D) of the anterior section of a jaw bone was preserved. The base has the latero-medial concavity characteristic of acanthodian jaw bones, marking the position of the jaw cartilage (Fig. 6D). The occlusal surface has a medial ridge, and a higher lateral ridge, separated by a shallow groove. Only one cusp is preserved, on the broken posterior extremity of the fragment.

Several small fin spine fragments (Fig. 7A-C) up to 2mm long were in the assemblage; some of these were sectioned (Fig. 7B,C). The spines are ornamented with relatively smooth and rounded, parallel, longitudinal ribs. The anterior rib, forming the leading edge of the spine, is widest, followed by three ribs each about 0.1mm wide. All ribs are separated by rounded grooves of equal width. A wider groove separates these ribs from the posterior area of the spine, which varies in width depending on the age of the spine.

REMARKS

The material described comprises the sum of the determinable acanthodian elements in the sample, and by comparison with the range of elements in articulated specimens of *Poracanthodes menneri* Valiukevicius, 1992, is interpreted as belonging to a single species. Gross (1971), in attributing scales, tooth whorls, dentigerous jaw bones, and fin spines to *Gomphonchus sandelensis*, and *Gomphonchus* sp., considered that *Poracanthodes* (Brotzen, 1934) was not an independent genus, and believed poracanthodid scales to be modified lateral line scales of *G. sandelensis* and *G. hoppei*. Whereas *Poracanthodes* is now recognized as a valid genus, no articulated specimens of *Gomphonchus* have yet been found. As Gross did not attribute any dental elements or fin spines to *Poracanthodes*, it is probable that some of the elements he assigned to *Gomphonchus* are referrable to *Poracanthodes* (see Burrow, in press, b, for further discussion of this topic).

Unfortunately, remineralization and fungal hyphae have obscured histological detail of the Jack Formation scales, precluding a firm generic classification based on the scales alone. Morphologically, the posterior crown section of morphotype III scales appear to show areal rather than superpositional growth (Fig. 2F-H), as in scales of *Poracanthodes menneri*. Pore canal networks are not detected, however, in ground thin sections of *G.? turnerae* sp. nov. scales. The growth zone

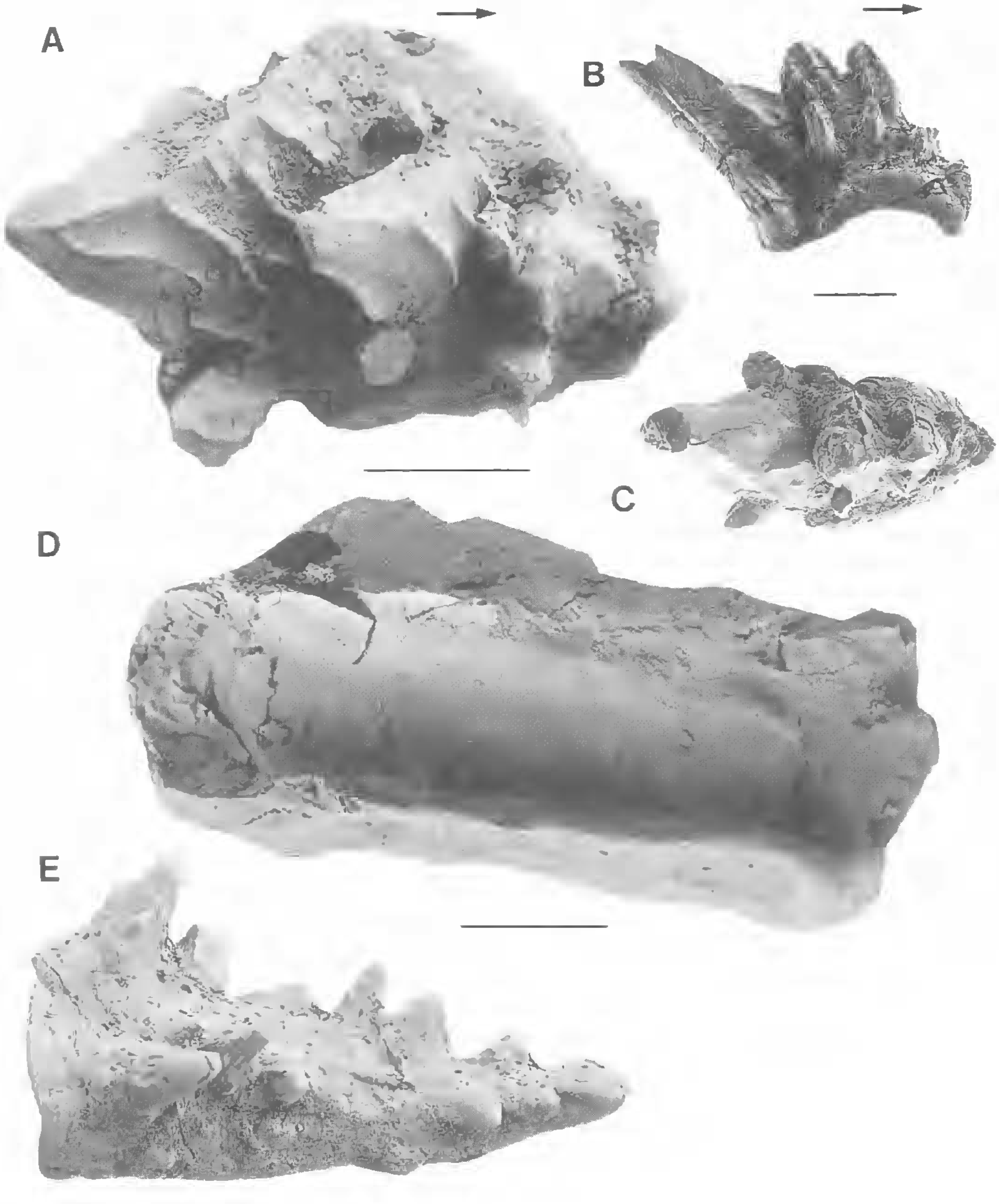

FIG. 6. Symphysial tooth whorls, dentigerous jaw bone fragment, and dentition cone of *G.*? *turnerae* sp. nov., from the Jack Formation. A-D are from sample BR07-02, E is from BR07-01. A, occlusal view of paratype tooth whorl, UQY7697, with branching, noded ridges. B,C, tooth whorl UQY7706. B, in lateral view. C, occlusal view. D, concave base of dentigerous jaw bone fragment UQY7699. E, lateral view, dentition cone UQY7698. Arrow points in a rostral direction. Scale bar = 0.2mm.

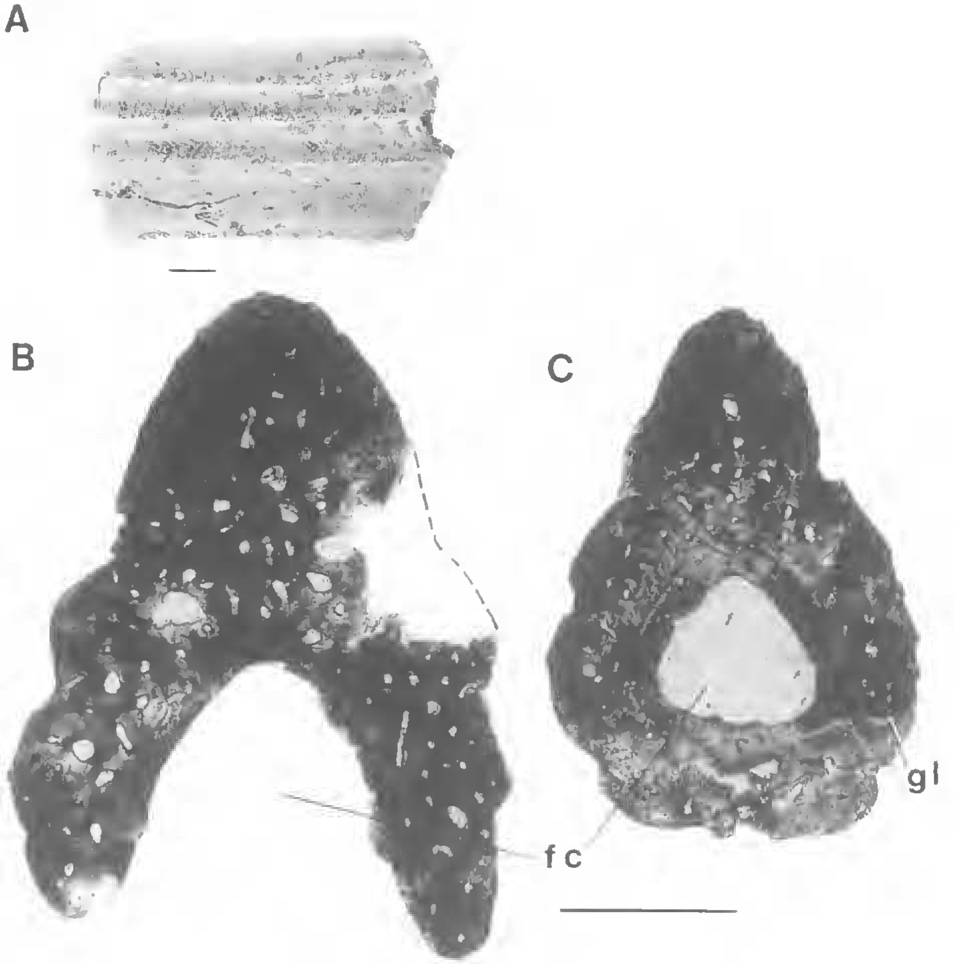

FIG. 7. Fin spine fragments of *G.*? *turnerae* sp. nov., from BR07-02, Jack Formation. A, lateral view, UQY7715. B, cross-section of a juvenile fin spine, with open cavity, UQY7704. C, Cross-section of fin spine with two growth zones, UQY7705. fc = longitudinal fin spine cavity, gl = growth line delimiting first growth zone. Scale bar = 0.2 mm.

'cracks' on these scales are probably an artifact of preservation, caused by the thinness of the growth zones in the posterior crown, abrasion, and fungal invasion. This theory is enhanced by the lack of pore canal openings on the crown of morphotype V head scales, as comparable scales on *P. menneri* have many such openings (Valiukevicius, 1992; pl. 9, fig. 6a,b). Morphotype V head/sensory line scales are commonly found in microvertebrate assemblages (e.g., Burrow, in press, a; pl. 3, fig. 14; and possibly Mader, 1985; pl. 3, fig. 2), and are similar to the sensory line scales on the head of *Ischnacanthus gracilis*, in Miles (1966; fig. 11) and Bernacsek & Dineley (1977; pl. 6, fig. 4). Morphotype IV head scales appear the same as the special head scales of *P. menneri* (Valiukevicius, 1992; pl. 9, figs 2-4). Only the poorly represented morphotype VI scales assigned to *G.*? *turnerae* have the pore canal openings on the underside of the posterior crown, which are typical of *Poracanthodes* scales.

The symphysial tooth whorls (Fig. 6A-C) resemble those attributed to "*Gomphodus*" *sandelensis* by Gross (1957; fig. 1), and differ from the lone, small, tri-cusped whorl assigned to

P. menneri (Valiukevicius, 1992; figs. 5a,b). However, the latter whorl was broken, and the number of teeth per whorl is probably variable, as illustrated by Gross (1957; figs 1,2) for "*Gomphodus*" *sandelensis*. The *G.? turnerae* whorls differ to all previously described examples by their distinctive, branching, longitudinal ridges (Fig. 6A); this ornament gives the cusps a 'tubercular' appearance.

The *G.? turnerae* fin spine fragments (e.g., Fig. 7A) resemble those of *P. menneri* (e.g. Valiukevicius, 1992; text fig. 11B). Fin spines of the ischnacanthids *Ischnacanthus gracilis*, *P. menneri*, and *Gomphonchus* sp., conform to a common pattern of smooth, longitudinal ribs, with the leading rib wider than the following ribs. The number of the narrower ribs varies with the age of fish, and the position of the spine on the body (Valiukevicius, 1992; 205). Gross (1971; figs 24E,F, 25A,C,D,E, 26A) illustrated cross-sections of young and old spines, showing the increasing number of growth zones corresponding to the age of the spine, which leads to the variation in their external morphology. Fin spine ornamentation, thus, is as yet of limited use in assigning fin spines to any of these ischnacanthid genera.

A comparable suite of acanthodian elements, incorporating all elements listed for *G.? turnerae* except the morphotype IV scales, was observed in microvertebrate assemblages from several sites in the Lower Devonian Trundle beds of central New South Wales (Burrow, in press, a, b). This particular range of elements was tentatively attributed to a new taxon. Only a small percentage of the Trundle beds scales of this taxon had pore canal openings on the upper surface of the crown, just as in the *G.? turnerae* sample. Determining if the new ischnacanthid should be assigned to *Poracanthodes*, or *Gomphonchus*, or a new genus, is difficult without scales which have been well preserved histologically. Primarily on the basis of the lack of a discernible pore canal system, and the apparent absence of bone cell lacunae in the base, they are assigned to *Gomphonchus*? rather than *Poracanthodes* because of the lack of good histological detail, they are not assigned to a new genus. A scale figured by Turner et al. (1995; fig. 5J) from an erratic block of the Lorentz River, east Irian Jaya (late Ludlow age), appears to be a morphotype III scale of *G. turnerae*. *Gomphonchus*? *turnerae* is the oldest acanthodian described from Australian assemblages.

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